Truth seekers in opinion dynamics models

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We modify the model of Deffuant *et al.* to distinguish true opinion among others in the fashion of Hegselmann and Krause (`http://jasss.soc.surrey.ac.uk/9/3/10.html`). The basic features of both models modified to account for truth seekers are qualitatively the same.

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Introduction. Opinion dynamics simulations[1,2,3,4] (see Ref. 5 for review) seem to be the most fashionable part of sociophysics[6]. When your girlfriend asks you 'Do I look fine?' you may use the Sznajd model[2] to answer this general question as Sznajd agents behave similarly to magnetic spins: they are allowed to have only two opinions $s_i \in \{0, 1\}$ — for example 'yes' or 'no'. But when the question is open — for instance: 'How am I looking like today?' — the space of possible answers enlarges drastically. The correct answers are 'Super!' and 'Exceptionally!' but not 'O.K.' or even 'nice'. The latter is reserved for the same question but about a pretty girl starring in any Hollywood movie. For modeling such opinions the Hegselmann–Krause[3] (H-K) or Deffuant *et al.*[4] models are more appropriate as they offer a continuous interval of possible opinions $s_i \in [0, 1]$.

Now, you and your interlocutor may have a wrong opinion about your girlfriend. The truth may be elsewhere. The modifications of H-K model which allow to introduce truth seekers among exchanging their opinions agents were presented very recently in Ref. 7.

In this paper we would like to check if the same is available for Deffuant *et al.* model[4] were Assmann[8] had already introduced a multitude of truths.

The model. In the original Deffuant *et al.* model two persons (let say i and j) exchange their opinion about given topic if their current opinions do not differ more than *confidence level* ε, i.e. when $|s_i - s_j| \le \varepsilon$. In such case, after discussion their change their opinions slightly, i.e.

$$\begin{cases} s_i \to & s_i + \mu\delta \\ s_j \to & s_j - \mu\delta \end{cases}, \qquad (1)$$

where $\delta = s_j - s_i$ and $\mu \in [0, 1/2]$ describes a speed of opinion changes. If their opinions are too distant, i.e. $|\delta| > \varepsilon$, the agents do not change their opinions at all.

To account for the true opinion Hegselmann and Krause introduced two additional parameters: $T \in [0, 1]$ and α_i — which represent the *true* opinion and the *strength of the attraction to the truth* for i-th agent, respectively[7].

With these two additional terms Eq. (1) for the Deffuant *et al.* model becomes

$$\begin{cases} s_i \to & s_i + \mu[\alpha_i(T - s_i) + (1 - \alpha_i)\delta] \\ s_j \to & s_j + \mu[\alpha_j(T - s_j) - (1 - \alpha_j)\delta] \end{cases}. \qquad (2)$$

The case $\alpha_i = 0$ $(i = 1, \cdots, N)$ corresponds to the original Deffuant *et al.* model and for $\alpha_i = 1$ $(i = 1, \cdots, N)$ agents do not exchange opinions each to other but tends towards the true one.

The results. In Fig. 1 the results of simulation are presented for opinion dynamics of $N = 500$ agents with initially randomly chosen opinions s_i (the same for all sub-figures). The model parameters are shown in the headline of all sub-figures. In Fig. 1(a) the opinion dynamics governed by original Deffuant *et al.* model is presented ($\alpha_i = 0$ for all i). In Fig. 1(b) all agents are the truth seekers. In Figs. 1(c)–(e) half of agents is the truth seeker ($\alpha_i > 0$, marked as green) while the second half is not ($\alpha_i = 0$, marked as red). In Fig. 1(f) only 2% agents search for the truth. Parts c/d, c/e, c/f differ *only* with T, ε and the fraction of the truth seekers, respectively. For $N = 10^2$ and 10^3 the results are qualitatively the same.

The obtained results support the observation from Figs. 1–8 in Ref. 7.

In conclusions, the Deffuant *et al.* model[4] with necessary modifications which allow to simulate true opinion among others gives qualitatively the same results as the H-K model modified for the same purpose[7].

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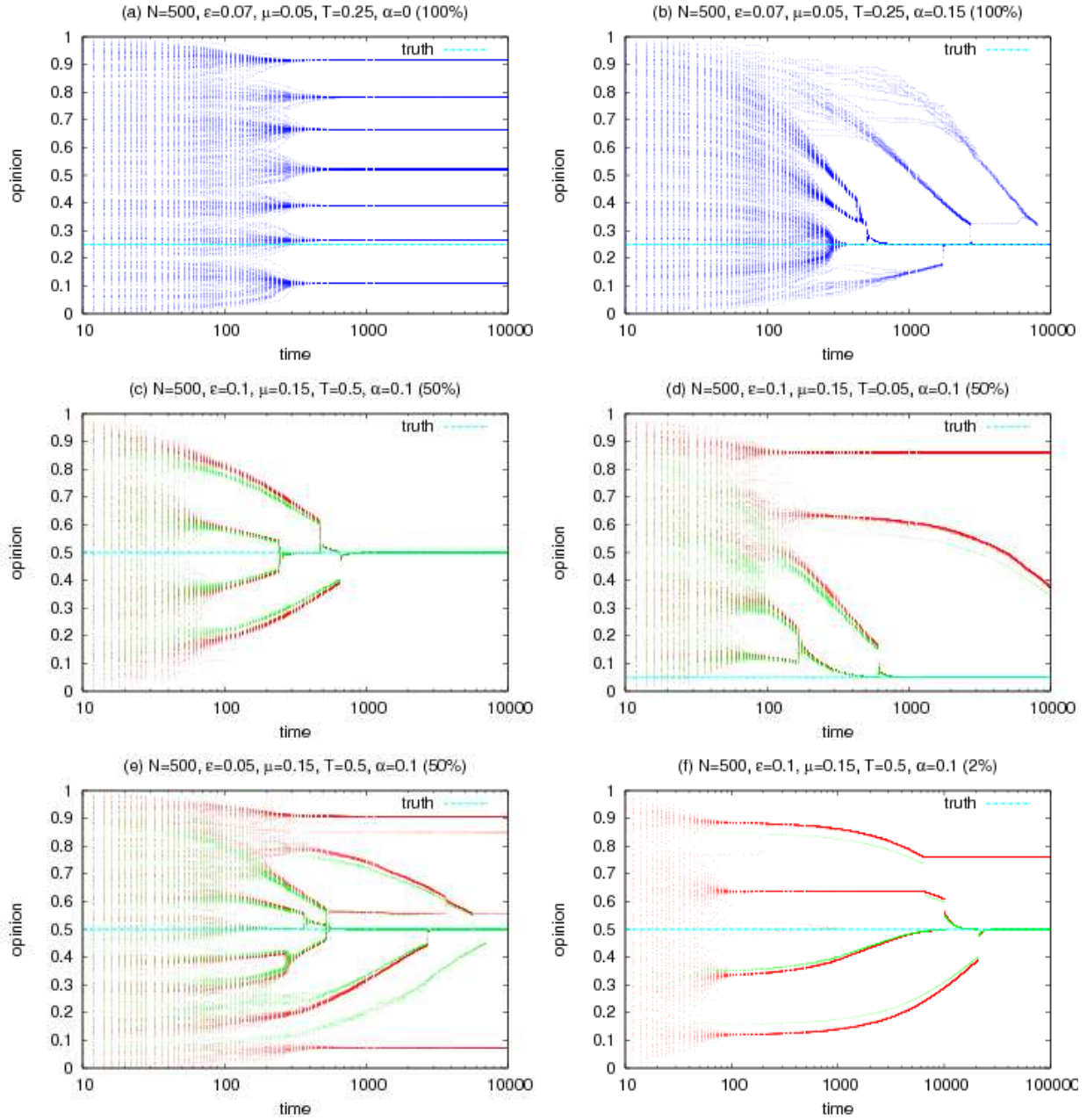
FIG. 1: (Color online). A few examples of opinion dynamics for Deffuant model with truth seekers. The model parameters and given in sub-figures captions. The straight horizontal line indicates the 'truth'.

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